16 filler piece
17 surface portion of the polygonal circumferential surface
18 recess
19 projection
20 filler strips
21 (further) filler strips
22 ring
23 metal sheet
24 centering tube
25 holes
26 longitudinal slot
27 channel
28 threaded hole
29 cage
30 end ring
31 longitudinal rods
32 transverse grooves
33 arrow
34 arrow
35 core
36 internal space
37 neutral zone
38 shear bolt

PATENT CLAIMS

1. Process for the production of a rotor of a synchronous machine, containing permanent magnets (2), the said rotor having a core (1, 35) of ferromagnetic steel, on and connected to which core (1, 35) are permanent magnets (2) which in their turn are surrounded by an outer cylinder (3) of a non-magnetizable material, and which rotor has at both axial ends closure plates (4, 5) of a non-magnetizable steel with stub shafts (6, 7), wherein the core (1, 35) is constituted with an internal space (8, 36) and a resin mass is introduced into the internal space (8, 36), the said resin mass being supplied to the region of the permanent magnets (2) by centrifuging the rotor, in which region hardening of the resin mass takes place.

2. Process according to claim 1, wherein the rotor with the introduced resin mass is heated and simultaneously run up to speed, the resin mass being conducted outward, due to centrifugal force, from the internal space (8) through radial channels (27) in the core (1), or from the internal space (36) through holes (25) and longitudinal slots (26) in the core (35), to the region of the permanent magnets (2), and the cavities present there are filled up, and wherein the rotor is kept at the centrifuging speed during the hardening of the resin mass.

3. Process according to claim 1 or 2, wherein for the assembly of the rotor, the permanent magnets (2) are arranged on the core (1, 35), and the core (1, 35) with the permanent magnets (2) is inserted with play into the outer cylinder (3); and wherein after the introduction of the resin mass into the internal space (8, 36), a respective closure plate (4, 5) each consisting of non-magnetizable steel with a stub shaft (6, 7) is arranged at each end of this structure originating from the core (1, 35), permanent magnets (2), outer cylinder (3) and resin mass, and the core (1, 35) is centered in the closure disks (4,5); and wherein finally the outer cylinder (3) is connected to the closure disks (4, 5).

4. Process according to one of the foregoing claims, wherein the hardenable resin mass is introduced into the internal space (8, 36) in the core (1, 35) in the form of a solid rod.

5. Process according to one of the foregoing claims, wherein the resin mass contains at least one filler.

6. Process according to one of the foregoing claims, wherein the outer cylinder (3) is shrunk onto the closure disks (4, 5).

7. Process according to claim 6, wherein the shrunk-on outer cylinder (3) is connected flush to the closure disks (4, 5) by means of a circumferential weld seam (9).

8. Process according to claim 7, wherein the circumferential weld seam (9) is pre-welded in only one pass before the centrifuging of the adhesive resin and is only completely after-welded after the hardening of the adhesive resin.

9. Process according to claim 6, wherein the outer cylinder (3) is constituted at both ends with an inner circumferential groove (10) and the closure disks (4, 5) are constituted with an outer circumferential projection (11) and an adjacently arranged outer circumferential groove (12) with an inserted O-ring (13), and the outer cylinder (3) is shrunk onto the closure disks (4, 5) such that the respective outer circumferential projection (11) of the closure disks (4, 5) projects into the respective inner circumferential groove (10), and the respective O-ring (13) abuts the outer cylinder (3) flush.

10. Process according to one of claims 1-5, wherein the closure disks (4, 5) are constituted with a cone-shaped portion (14) directed toward the rotor interior, and are pressed into the outer cylinder (3), to connect with it, as far as a stop (15).

11. Process according to one of the foregoing claims, wherein magnetic neutral zones (37) are present in annular space portions between the core (1, 35) and the outer cylinder (3), which neutral zones (37) contain no permanent magnets (2), wherein filler pieces (16) are inserted into these annular space portions, the density of the material of the filler pieces (16) being at least approximately equal to the density of the material of the permanent magnets (2).

12. Process according to one of the foregoing claims, wherein filler strips (20) are inserted between adjacent permanent magnets (2).

13. Process according to one of the foregoing claims, wherein further filler strips (21) are inserted between the permanent magnets (2) and the inner circumferential regions of the outer cylinder (3) lying opposite.

14. Process according to claim 13, wherein, in order to form a damping cage, the further filler strips (21) are connected at their ends by spot welding or the like to a respective flexibly constituted ring (22) and are arranged around the core (1, 35), and the closure disks (4, 5) are then installed.

15. Process according to one of claims 1-11, wherein a cage (29) of an electrically conductive material is produced, with end rings (30) and axially-running longitudinal rods (31) with transverse grooves (32) for distributing the adhesive resin, and the permanent magnets (2) are inserted into the cage (29); and wherein either the cage (29) with the permanent magnets (2) is pushed into the outer cylinder (3), the permanent magnets (2) are adhered to the outer cylinder (3) with a provisional adhesive and thereafter the core (1, 35) is pushed into the cage (29), or the core (1, 35) is first pushed into the cage (29) and thereafter the outer cylinder (3) is pushed over the cage (29) with the permanent magnets (2).

16. Process according to one of claims 1-14, wherein metal sheets (23) are stacked on a centering tube (24) for the production of the core (35), which centering tube (24) has holes (25) for the passage of resin mass arranged in its internal space (36), the metal sheets (23) having slots (26) aligned with the holes (25) for the further passage of the adhesive resin.

17. Process according to one of claims 1-15, wherein the core (1) is integral and is constituted with an internal space (8), which internal space (8) serves as a storage space for the resin mass, and from which internal space (8) channels (27) are constituted running in a radial direction toward the outside of the core (1).

18. Process according to one of the foregoing claims, wherein the core (1, 35) is constituted at both axial ends with a polygonal recess (18), each closure disk (4, 5) being constituted with a polygonal projection (19) corresponding to the recesses (18) of the core (1, 35); and wherein, in assembling the rotor, the projections (19) are inserted into the recesses (18), in order to form a positive connection for force transmission between the core (1, 35) and the closure disks (4, 5).

19. Process according to one of the foregoing claims, wherein the outer circumferential surface of the core (1, 35) is constituted of polygonal shape with many planar surface portions (17), the dimensions of each individual surface portion being conformed to the dimensions of the permanent magnets (2), so that on the one hand a minimum magnetic gap is formed between the core (1, 35) and the permanent magnets (2) arranged on the surface portions (17), and on the other hand an excellent transmission of torque from the permanent magnets (2) to the core (1, 35) is attained.

20. Rotor containing permanent magnets (2), produced by the process according to claim 1, which has a core (1, 35) of ferromagnetic steel and an internal space (8, 36) running axially, on which core (1, 35) permanent magnets (2) are arranged, and which is surrounded by an outer cylinder (3) of non-magnetizable material, the said rotor having closure disks (4, 5) of non-magnetizable steel with stub shafts (6, 7), which are positively connected to the core (1, 35) and at least frictionally to the outer cylinder (3); and wherein after interfusing the resin at least all the cavities in the region of the permanent magnets (2) are filled with a resin mass as far as the diameter of the internal space (8, 36).

21. Rotor according to claim 20, wherein the outer cylinder (3) is shrunk onto the closure disks (4, 5).

22. Rotor according to claim 21, wherein the shrunk-on outer cylinder (3) is connected flush to the closure disks (4, 5) by means of a circumferential weld seam (9).

23. Rotor according to claim 21, wherein the outer cylinder (3) has a circumferential groove (10) at each end, and the closure disks (4, 5) have an outer circumferential projection (11) and an adjacently arranged circumferential groove (12) with an inserted O-ring (13), with the said outer circumferential projections (11) projecting into the respective inner circumferential groove (10) and the said O-ring (13) abutting the outer cylinder (3) flush.

24. Rotor according to claim 20, wherein each closure disk (4, 5) has a cone-shaped portion (14) directed toward the rotor interior and has a shoulder portion (15) serving as a stop, the said closure disks (4, 5) being pressed into the outer cylinder (3) and abutting it with the shoulder portion (15).

25. Rotor according to one of claims 20-24, with magnetic neutral zones (37) present in the annular space portions between the core (1, 35) and the outer cylinder (3), the said neutral zones (37) containing no permanent magnets, wherein filler pieces (16) are arranged in these annular portions, the density of the material of the filler pieces (16) being at least approximately the same as the density of the material of the permanent magnets (2).

26. Rotor according to one of claims 20-25, wherein filler strips (20) are arranged between adjacent permanent magnets (2).

27. Rotor according to one of claims 20-26, wherein further filler strips (21) are arranged between the permanent magnets (2) and the inner circumferential regions of the outer cylinder (3) opposite to these.

28. Rotor according to claim 27, wherein the further filler strips (21) consist of an electrically conducting material and, for the formation of a damping cage, are connected at their ends to a flexibly constituted ring (22) within which the core (1, 35) is arranged.

29. Rotor according to one of claims 20-25, wherein it has a cage (29) of electrically conducting end rings (30) and longitudinal rods (31) with transverse grooves (32) for the distribution of the adhesive resin, the permanent magnets (2) being inserted into the said cage (29).

30. Rotor according to one of claims 20-28, wherein the core (35) is formed by a metal sheet packet arranged on a centering tube (24) which centering tube (24) has holes (25), and wherein the metal sheets (23) of the metal sheet packet at these holes (25) have longitudinal slots (26) running in the radial direction and aligned with the holes (25).

31. Rotor according to one of claims 20-29, wherein the core (1) is integral and has an internal space (8) from which internal space (8) channels (27) run in a radial direction to the outside of the core (1).

32. Rotor according to one of claims 20-31, wherein, for torque transmission from the core (1, 35) to the closure disks (4, 5), the core part (1, 35) has a polygonal recess (18) at each axial end, and each closure disk (4, 5) has a polygonal projection (19) projecting into the respective recess (18).

33. Rotor according to one of claims 20-32, wherein the core (1, 35) has a polygon-shaped outer circumferential surface, consisting of individual plane-surfaced surface portions (17), whereby the surface portions (17) correspond to the dimensions of the permanent magnets (2) abutting the same.

34. Rotor according to one of claims 20-29, wherein the metal sheets (38) of steel are inserted at one end into the metal sheets (23) and at the other end into the closure disks (4, 5).

ABSTRACT

The rotor has a core (1) with an internal space (8). Permanent magnets (2) are arranged on the core (1). These permanent magnets (2) are surrounded by an outer cylinder (3), which is connected flush to closure disks (4, 5) which bear stub shafts (6). Channels (27) run out from the internal space (8) in the radial direction to the region of the permanent magnets (2). A resin mass is first introduced into the internal space (8). The rotor is thereafter heated and run up to centrifuging rotational speed. As a result, the molten resin mass flows through the channels (27) to the region of the permanent magnets (2) and fills up all the cavities present there and also cracks which form in the brittle permanent magnets (2) on running up to speed. The resin mass hardens while the rotor is kept at centrifuging rotational speed. Each surface region of the permanent magnets (2) is thus reliably protected against corrosion.

(Fig. 1)